

PATENT ABSTRACTS OF JAPAN

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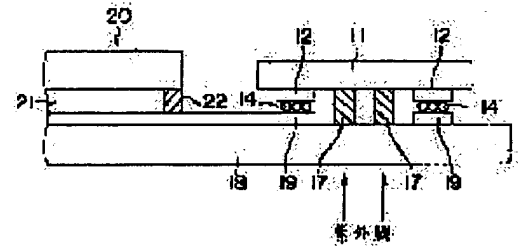
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(54) CONNECTION OF SEMICONDUCTOR DEVICE

(57)Abstract:

PURPOSE: To repair a semiconductor device easily by including a process wherein the semiconductor device is provisionally secured.

CONSTITUTION: On one face of a semiconductor device 11 where an input/output electrode 12 is installed, a photosetting adhesive 17 is so dropped that it may not be extended in all the space between the semiconductor device 11 and a glass substrate 18. Fine grains 14 provided in the input/output electrode 12 and a wiring electrode 19 on the glass substrate 18 are pressure-welded and then ultraviolet rays are cast to harden the photosetting adhesive 17 for provisionally securing the semiconductor device 11 onto the glass substrate 18. Then, an electric test is conducted. When the semiconductor device 11 proves bad, it is not necessary to consider an influence given to the glass substrate 18 by an adjacent liquid crystal cell 20 or the removal of a residual of the adhesive. So, a repairing work can be done easily. When the semiconductor device 11 is good, the space between the normal semiconductor device 11 and the glass substrate 18 is completely filled with the photosetting adhesive 17 to complete the connection of the semiconductor device 11.



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TECHNICAL FIELD

[Industrial Application] Especially this invention relates to amelioration of the connection method of the semiconductor device which makes pressurization contact connection of the semiconductor device by face down with adhesives on wiring substrates, such as a printed circuit board, a ceramic substrate, a glass substrate, a metal base substrate, or a flexible substrate, about the connection method of a semiconductor device.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] Especially this invention relates to amelioration of the connection method of the semiconductor device which makes pressurization contact connection of the semiconductor device by face down with adhesives on wiring substrates, such as a printed circuit board, a ceramic substrate, a glass substrate, a metal base substrate, or a flexible substrate, about the connection method of a semiconductor device.

[0002]

[Description of the Prior Art] The approach of making face down connection of the semiconductor device on a wiring substrate using adhesives is proposed variously, without being based on the alloy diffusion connection using an alloy like solder in recent years (for example, Hatada, etc. the Institute of Electronics, Information and Communication Engineers technical research reports "application of a micro bump bonding method", Vol.88, No.233, and CPM 88-64 (1988)).

[0003] As shown in drawing 6, a photo-setting resin 6 is dropped on a ceramic substrate 1, and he irradiates ultraviolet rays and is trying to stiffen a photo-setting resin 6 according to the approach proposed by above-mentioned Hatada etc., pressurizing by performing alignment of the bump 4 on the electrode 3 of a semiconductor device 2, and the wiring electrode 5 on a ceramic substrate 1. In this way, the mounting gestalt with which the photo-setting resin 6 was filled up into all the gap sections of a ceramic substrate 1 and a semiconductor device 2 is acquired.

[0004]

[Problem(s) to be Solved by the Invention] As mentioned above, the closure of the semiconductor device mounted by the approach of making face down connection of the semiconductor device on a wiring substrate using adhesives is completely carried out by adhesives. Therefore, in case a poor semiconductor device is discovered and semiconductor devices are exchanged by the electric test after mounting (the so-called repair), it is necessary to take into consideration the effect on adhesives etc. and the removal of adhesives residue which are closing the adjoining semiconductor device, damage on a wiring substrate, etc., and there is a problem that repair is very difficult.

[0005] Then, the purpose of this invention is to offer the connection method of the semiconductor device which makes repair easy.

[0006]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, the connection method of the semiconductor device of this invention The inclusion with which a surface layer has electrical conductivity at least is prepared in one [at least] top among the electrode on a semiconductor device, and the electrode on a wiring substrate. It is the connection method of the semiconductor device which makes pressurization connection of the above-mentioned semiconductor device by face down with adhesives on the above-mentioned wiring substrate through this inclusion. To a field narrower than the front face of the above-mentioned semiconductor device and the above-mentioned semiconductor device of the front face by the side of the electrode in either of the wiring substrates The adhesives of the amount of only a wrap are supplied for a field smaller than the area which the above-mentioned semiconductor device and the wiring substrate have countered when the above-mentioned semiconductor device is connected on a wiring substrate. Pressurization contact of the above-mentioned semiconductor device is carried out by face down on a wiring substrate, and it is characterized by stiffening the above-mentioned adhesives, connecting the above-mentioned semiconductor device on a wiring substrate, and making all the remaining fields in the gap section of the account semiconductor device of Gokami and wiring substrate supply and harden adhesives.

[0007]

[Example] Hereafter, the example of illustration explains this invention to a detail. Drawing 1 thru/or drawing 3 are the sectional views showing the connection process of the semiconductor device concerning this example. Hereafter, according to drawing 1 thru/or drawing 3, the connection method of the semiconductor device of this example is explained.

[0008] First, as shown in drawing 1, the minute particle (it omits in drawing 1) as inclusion for obtaining electrical installation with the wiring electrode on a glass substrate to the I/O electrode 12 formed in the front face of the semiconductor devices 11, such as a silicon chip which made active elements and passive elements, such as a transistor, diode, and a capacitor, is prepared. the approach (for example, new others "the 6th international microelectronics meeting report (Proceedings of the 6 th International Microelectronics Conference)" (1990) p. approach given in 190) of various known [particle / this / minute] -- for example, it prepares as follows.

[0009] Drawing 4 is the expanded sectional view of I/O electrode 12 near [the above-mentioned semiconductor device 11]. The above-mentioned I/O electrode 12 consists of Au/Ti-W/aluminum-Si (the maximum upper layer is Au), and the perimeter is protected by the insulator layers 13, such as silicon nitride. And two or more minute particles 14 are laid on opening of this I/O electrode 12. This minute particle 14 has structure as shown in drawing 5. That is, Au plating 16 has been performed to the ball 15 with a diameter of 10 micrometers which uses a macromolecule as a core, and it has conductivity.

[0010] Next, the photoresist adhesives 17 are supplied to the front face by the side of the I/O electrode 12 of the above-mentioned semiconductor device 11. The photoresist adhesives 17 in that case supply the amount of extent which can connect a semiconductor device 11 and a glass substrate electrically and mechanically, without crossing to all the fields of the gap section of a semiconductor device 11 and the above-mentioned glass substrate, and spreading by the micro dispenser, when it mounts a semiconductor device 11 on the glass substrate of a liquid crystal cell.

[0011] As shown in drawing 2 such the back, the I/O electrode 12 of the semiconductor device 11 which should connect liquid crystal 21 with the wiring electrode 19 on the glass substrate 18 of the liquid crystal cell 20 which closes and changes by resin 22 beforehand is made to counter, and alignment of a semiconductor device 11 is performed. And the wiring electrode 19 on a glass substrate 18 is made to carry out pressurization contact of the minute particle 14 on the I/O electrode 12 of the above-mentioned semiconductor device 11, and ultraviolet rays are irradiated from the rear face of a glass substrate 18. In this way, the above-mentioned photoresist adhesives 17 are stiffened by ultraviolet rays. In this phase, a semiconductor device 11 and a glass substrate 18 will be in the condition connected electrically and mechanically through the minute particle 14, i.e., a tacking condition.

[0012] After an appropriate time, the electric test of the connection of the semiconductor device 11 in the above-mentioned tacking condition and a glass substrate 18 is performed. Consequently, when it becomes clear that there are the above-mentioned semiconductor device's 11 being a defect semiconductor device and a faulty connection and the need for repair arises, a semiconductor device 11 is removed by the suitable approach. In that case, since it is only tacking carried out of the semiconductor device 11 by a small amount of photoresist adhesives 17, its adhesion area is small, and the semiconductor device 11 can be removed very easily, without having a bad influence on the liquid crystal cell 20 and glass substrate 18 which are prepared adjacently, or adhesives residue arising.

[0013] Then, it carries out [tacking] of the semiconductor device which has a good property anew to the same wiring electrode 19 by the same approach as ****. And an electric test is carried out again. Hereafter, this is repeated until it obtains a good electric test result.

[0014] And when it becomes clear by the above-mentioned electric test that there is no fault in a semiconductor device for example, as shown in drawing 3, the photoresist adhesives 17 are supplied by the dispenser also to all the remaining fields of the gap section of a normal semiconductor device 23 and a normal glass substrate 18, ultraviolet rays are irradiated, and the photoresist adhesives 17 are stiffened. In this way, the closure of the semiconductor device 23 is completely carried out on a glass substrate 18, and it is connected completely mechanically electrically [the minute particle 25 attached at the I/O electrode 24 of a semiconductor device 23, and the wiring electrode 19 on a glass substrate 18].

[0015] Thus, in this example, since it carries out [tacking] of the semiconductor device 11 with a small amount of photoresist adhesives 17 on a glass substrate 18 and was made to carry out an electric test, when a semiconductor device 11 is faulty, there is no need for the consideration to the effect to an adjoining liquid crystal cell 20 and an adjoining glass substrate 18, removal of adhesives residue, etc., and it can repair easily. Moreover, if there is no un-arranging as a result

of the above-mentioned electric test, since all the gap sections of a normal semiconductor device 23 and a normal glass substrate 18 will be filled with the photoresist adhesives 17, the closure of the semiconductor device 23 is completely carried out with the photoresist adhesives 17, and the I/O electrode 24 of a semiconductor device 23 and the wiring electrode 19 of a glass substrate 18 are connected electrically completely [a machine target] through the minute particle 25.

[0016] In case the photoresist adhesives 17 for [tacking] are supplied to the I/O electrode 12 of the above-mentioned semiconductor devices 11 and 23, and the front face by the side of 24, especially the dropping location is not limited that what is necessary is just extent to which the drip does not spread as mentioned above in the whole gap section of semiconductor devices 11 and 23 and a glass substrate 18. However, it cannot be overemphasized that it is better to avoid the part of the I/O electrodes 12 and 24. In the above-mentioned example, although the photoresist adhesives 17 for [tacking] are supplied to semiconductor device 11 and 23 side, even if it supplies a glass substrate 18 side, it does not interfere at all.

[0017] As the above-mentioned semiconductor devices 11 and 23, you may be the semiconductor chip which used compound semiconductors other than an above-mentioned silicon chip, such as GaAs and InP. Moreover, as a wiring substrate to which the above-mentioned various semiconductor devices are connected, common wiring substrates other than the above-mentioned glass substrate 18, such as a printed circuit board, a ceramic substrate, a metal base substrate, or a flexible substrate, can also be used. Moreover, as adhesives which paste up the above-mentioned various semiconductor devices on various wiring substrates, the thermosetting adhesive other than the above-mentioned photoresist adhesives 17 may be used.

[0018] In the above-mentioned example, it uses for the front face of the ball 15 which uses a macromolecule as a core as inclusion which connects the I/O electrode 12 on a semiconductor device 11, and the wiring electrode 19 on a wiring substrate for the minute particle 14 which performed Au plating 16. However, it cannot be overemphasized that this invention is not limited to this and a bump with bulky golden bump, copper bump, etc. can be used as inclusion.

[0019]

[Effect of the Invention] So that clearly as mentioned above, the connection method of the semiconductor device of this invention Adhesives are supplied to a field narrower than the front face of a semiconductor device or the above-mentioned semiconductor device of the front face by the side of the electrode in either of the wiring substrates. Since the above-mentioned semiconductor device is connected on a wiring substrate, adhesives are supplied to all the remaining fields in the gap section of a tacking meal, its account semiconductor device of Gokami, and a wiring substrate and the above-mentioned semiconductor device was closed completely, an electric test can be carried out in the condition of eye tacking. And since the adhesion area by the adhesives in the above-mentioned tacking condition is quite smaller than the connection area of the above-mentioned semiconductor device, the above-mentioned semiconductor device is removable by the force smaller than the conventional connection method. Therefore, according to this invention, repair can be made easy.

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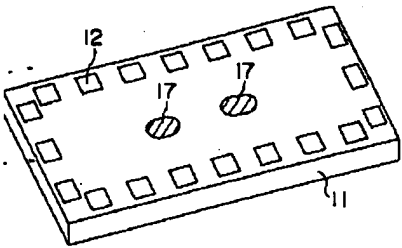
CLAIMS

[Claim(s)]

[Claim 1] The inclusion with which a surface layer has electrical conductivity at least is prepared in one [at least] top among the electrode on a semiconductor device, and the electrode on a wiring substrate. It is the connection method of the semiconductor device which makes pressurization connection of the above-mentioned semiconductor device by face down with adhesives on the above-mentioned wiring substrate through this inclusion. To a field narrower than the front face of the above-mentioned semiconductor device and the above-mentioned semiconductor device of the front face by the side of the electrode in either of the wiring substrates The adhesives of the amount of only a wrap are supplied for a field smaller than the area which the above-mentioned semiconductor device and the wiring substrate have countered when the above-mentioned semiconductor device is connected on a wiring substrate. Carry out pressurization contact of the above-mentioned semiconductor device by face down on a wiring substrate, stiffen the above-mentioned adhesives, and the above-mentioned semiconductor device is connected on a wiring substrate. Then, the connection method of the semiconductor device characterized by making all the remaining fields in the gap section of the above-mentioned semiconductor device and a wiring substrate supply and harden adhesives.

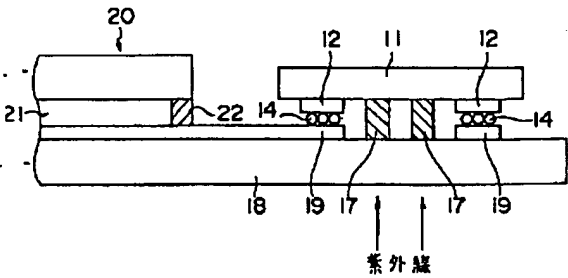
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Drawing selection ☒



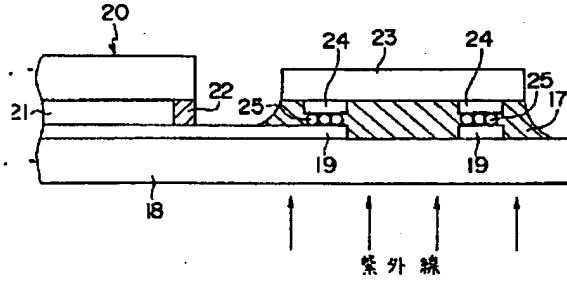
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Drawing selection drawing 2



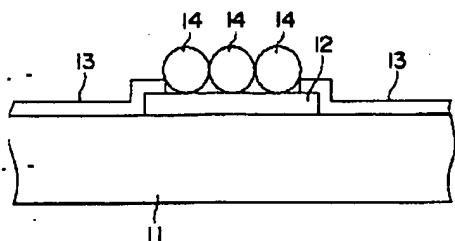
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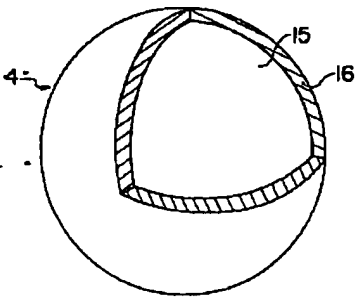
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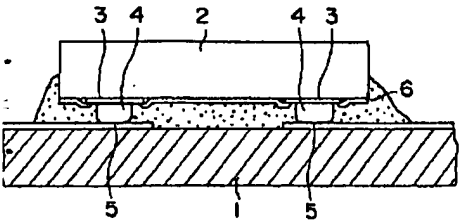
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Drawing selection



[Translation done.]

Drawing selection drawing 6 ☒



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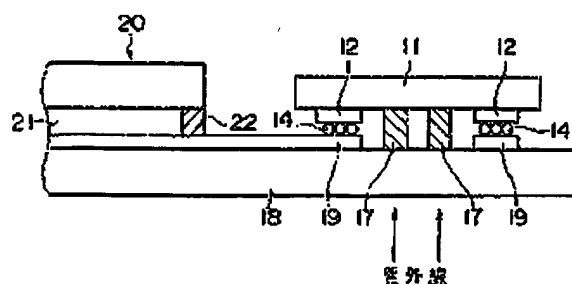
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(54)【発明の名称】 半導体装置の接続方法

(57)【要約】

【目的】 リヘアを容易にする半導体装置の接続方法を提供する。

【構成】 光硬化性接着剤17を半導体装置11における入出力電極12側の表面に供給する。その供給量は半導体装置11とガラス基板18との間隙部全体に並がない程度に滴下する。入出力電極12に設けられた微小粒子14とガラス基板18上の配線電極19とを圧接して紫外線を照射し、光硬化性接着剤17を硬化させて半導体装置11をガラス基板18に仮止めする。電気的テストの結果異常が無ければ半導体装置11とガラス基板18の間隙部の全部に光硬化性接着剤17を供給して半導体装置11を完全に接続する。このように、半導体装置



(2)

特開平5-267390

1

【特許請求の範囲】

【請求項1】 半導体装置上の電極と配線基板上の電極のうち少なくとも一方の上に少なくとも表面層が電気伝導性を有する介在物を設け、この介在物を介して上記配線基板上に上記半導体装置を接着剤によってフェイスダウンで加圧接続する半導体装置の接続方法であって、上記半導体装置および配線基板のいずれか一方における電極側の表面の上記半導体装置の表面より狭い領域に、上記半導体装置を配線基板上に接続した際に上記半導体装置と配線基板とが対向している面積よりも小さな領域を覆うだけの量の接着剤を供給し、上記半導体装置を配線基板上にフェイスダウンで加圧接触させ、上記接着剤を硬化させて上記半導体装置を配線基板上に接続し、その後、上記半導体装置と配線基板との間隙部における残りの全ての領域にも接着剤を供給して硬化させることを特徴とする半導体装置の接続方法。

【発明の詳細な説明】

【0001】

【産業上の利用分野】この発明は、半導体装置の接続方法に関し、特にプリント基板、セラミック基板、ガラス基板、金属ベース基板あるいはフレキシブル基板等の配線基板上に半導体装置を接着剤によってフェイスダウンで加圧接触接続する半導体装置の接続方法の改良に関する。

【0002】

【従来の技術】近年、半田のような合金を用いた合金拡散接続によらずに、接着剤を用いて配線基板上に半導体装置をフェイスダウン接続する方法が種々提案されている(例えば、畑田等“マイクロ・バンプ・ボンディング方式の応用”、電子情報通信学会技術研究報告、Vol.88、No.233、CPM88-64 (1988))。

【0003】上記畑田等によって提案された方法によれば、図6に示すように、セラミック基板1上に光硬化性樹脂6を滴下し、半導体装置2の電極3上のバンプ4とセラミック基板1上の配線電極5との位置合わせを行い、加圧しながら紫外線を照射して光硬化性樹脂6を硬化させるようにしている。こうして、セラミック基板1と半導体装置2との間隙部の全てに光硬化性樹脂6が充填された実装形態が得られるのである。

【0004】

【発明が解決しようとする課題】上述のように、接着剤を用いて配線基板上に半導体装置をフェイスダウン接続

2

【0005】そこで、この発明の目的は、リペアを容易にする半導体装置の接続方法を提供することにある。

【0006】

【課題を解決するための手段】上記目的を達成するため、この発明の半導体装置の接続方法は、半導体装置上の電極と配線基板上の電極のうち少なくとも一方の上に少なくとも表面層が電気伝導性を有する介在物を設け、この介在物を介して上記配線基板上に上記半導体装置を接着剤によってフェイスダウンで加圧接続する半導体装置の接続方法であって、上記半導体装置および配線基板のいずれか一方における電極側の表面の上記半導体装置の表面より狭い領域に、上記半導体装置を配線基板上に接続した際に上記半導体装置と配線基板とが対向している面積よりも小さな領域を覆うだけの量の接着剤を供給し、上記半導体装置を配線基板上にフェイスダウンで加圧接触させ、上記接着剤を硬化させて上記半導体装置を配線基板上に接続し、その後上記半導体装置と配線基板との間隙部における残りの全ての領域にも接着剤を供給して硬化させることを特徴としている。

【0007】

【実施例】以下、この発明を図示の実施例により詳細に説明する。図1乃至図3は、本実施例に係る半導体装置の接続過程を示す断面図である。以下、図1乃至図3に従って、本実施例の半導体装置の接続方法について説明する。

【0008】先ず、図1に示すように、トランジスタやダイオードやキャパシタ等の能動素子や受動素子を作り込んだシリコンチップ等の半導体装置11の表面に形成された入出力電極12に、ガラス基板上の配線電極との電気的接続を得るための介在物としての微小粒子(図1においては省略)を設ける。この微小粒子は、種々の既知の方法(例えば、新ほか“第6回国際マイクロエレクトロニクス会議報告(Proceedings of the 6th International Microelectronics Conference)” (1990) p.190に記載の方法)によって、例えば以下のように設ける。

【0009】図4は上記半導体装置11の入出力電極12付近の拡大断面図である。上記入出力電極12はAu/Ti-W/A1-Si(最上層がAu)から成り、その周囲が窒化シリコン等の絶縁膜13で保護されている。そして、この入出力電極12の開口部上に複数の微小粒子14が載置される。この微小粒子14は例えば図5に示すような構造を有している。すなわち、高分子をコアとする直径10μmの球15にAuメッキ16が施してあり、導電

(3)

特開平5-267390

3

機械的に接続できる程度の量をマイクロディスペンサで供給するのである。

【0011】そうした後、図2に示すように、予め樹脂22で液晶21を封止して成る液晶セル20のガラス基板18上の配線電極19と接続すべき半導体装置11の入出力電極12とを対向させて、半導体装置11の位置合わせを行う。そして、上記半導体装置11の入出力電極12上の微小粒子14をガラス基板18上の配線電極19に加圧接触させて、ガラス基板18の裏面から紫外線を照射する。こうして、紫外線によって上記光硬化性接着剤17を硬化させるのである。この段階で、半導体装置11とガラス基板18とは微小粒子14を介して電気的かつ機械的に接続された状態、つまり仮止め状態になる。

【0012】しかる後に、上記仮止め状態における半導体装置11とガラス基板18の接続部の電気的テストを行う。その結果、もし上記半導体装置11が不良半導体装置であることや接続不良があることが判明してリペアの必要性が生じた場合には、適当な方法によって半導体装置11を取り外す。その際に、半導体装置11は少量の光硬化性接着剤17によって仮止めされているだけなので接着面積が小さく、隣接して設けられている液晶セル20やガラス基板18に影響を及ぼしたり接着剤残渣が生じたりすることなく、非常に簡単に半導体装置11を取り外すことができるのである。

【0013】その後、改めて良好な特性を有する半導体装置を上述と同じ方法によって同じ配線電極19に仮止めする。そして、再度電気的テストを実施するのである。以下、このことを、良好な電気的テスト結果を得るまで繰り返す。

【0014】そして、例えば、上記電気的テストによって半導体装置に不良箇所がないことが判明した場合には、図3に示すように、正常な半導体装置23とガラス基板18との間隙部の残りの領域の全てにも光硬化性接着剤17をディスペンサで供給し、紫外線を照射して光硬化性接着剤17を硬化させる。こうして、半導体装置23はガラス基板18上に完全に封止され、半導体装置23の入出力電極24に取り付けられた微小粒子25とガラス基板18上の配線電極19とは電気的にかつ機械的に完全に接続されるのである。

【0015】このように、本実施例においては、半導体装置11をガラス基板18上に少量の光硬化性接着剤17で仮止めして電気的テストを実施するようにしたの

4

体装置23の入出力電極24とガラス基板18の配線電極19とは微小粒子25を介して電気的および機械的に完全に接続される。

【0016】上記半導体装置11,23の入出力電極12,24側の表面に仮止め用の光硬化性接着剤17を供給する際は、その滴下量が上述のように半導体装置11,23とガラス基板18との間隙部全体に並がらない程度であればよく、その滴下位置は特に限定するものではない。但し、入出力電極12,24の箇所は避けたいほうがよいことは言うまでもない。上記実施例においては、仮止め用の光硬化性接着剤17を半導体装置11,23側に供給しているが、ガラス基板18側に供給しても何等差し支えない。

【0017】上記半導体装置11,23としては、上述のシリコンチップの他に、GaAsやInP等の化合物半導体を用いた半導体チップであっても構わない。また、上記種々の半導体装置が接続される配線基板としては、上述のガラス基板18の他にプリント基板、セラミック基板、金属ベース基板あるいはフレキシブル基板等一般の配線基板を用いることもできる。また、上記種々の半導体装置を種々の配線基板に接着する接着剤としては、上記光硬化性接着剤17の他に熱硬化性接着剤を用いても構わない。

【0018】上記実施例においては、高分子をコアとする球15の表面にAuメッキ16を施した微小粒子14を半導体装置11上の入出力電極12と配線基板上の配線電極19とを接続する介在物として用いている。しかしながら、この発明はこれに限定されるものではなく、金バンプや銅バンプ等のバルキーなバンプを介在物として用いることができることは言うまでもない。

【0019】

【発明の効果】以上より明らかなように、この発明の半導体装置の接続方法は、半導体装置あるいは配線基板のいずれか一方における電極側の表面の上記半導体装置の表面より狭い領域に接着剤を供給して、上記半導体装置を配線基板上に接続して仮止めし、その後上記半導体装置と配線基板との間隙部における残りの全ての領域に接着剤を供給して上記半導体装置を完全に封止するようにしたので、仮止めの状態で電気的テストを実施することができる。しかも、上記仮止め状態での接着剤による接着面積は上記半導体装置の接続面積よりかなり小さいので、従来の接続方法よりも小さな力で上記半導体装置を除去できる。したがって、この発明によればリペアを

(4)

特開平5-267390

5

6

【図4】半導体装置の入出力電極付近の拡大断面図である。

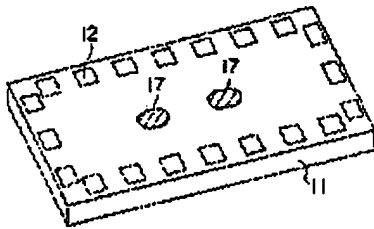
【図5】微小粒子の構造を示す図である。

【図6】従来の半導体装置の接続方法によってセラミック基板上に半導体装置を接続した状態を示す図である。*

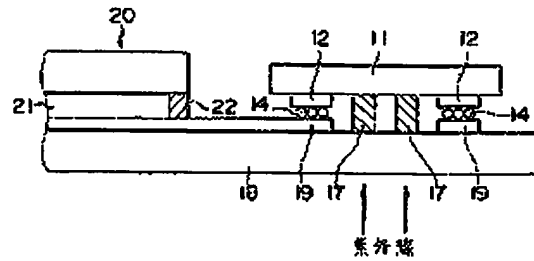
*【符号の説明】

11, 23...半導体装置、12, 24...入出力電極、14, 25...微小粒子、17...光硬化性接着剤、18...ガラス基板、19...配線電極、20...液晶セル。

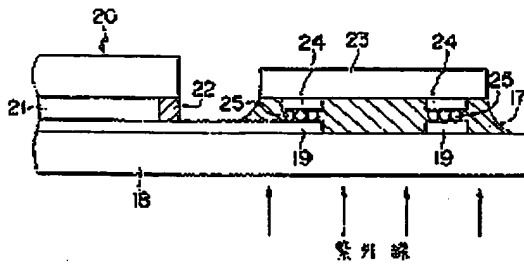
【図1】



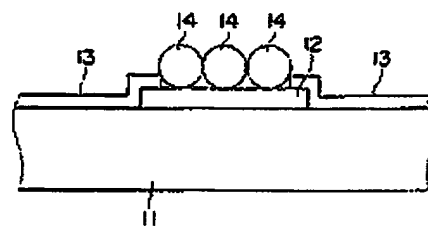
【図2】



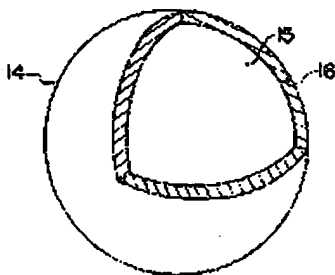
【図3】



【図4】



【図5】



【図6】

